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the dusky projection to which the passage of the "crape" ring across the globe gives rise being thus formed of an integration of these infinitesimal penumbral shadings.

Observatoire Flammarion, Juvisy (S.-et-O.),
1899 *August* 3.

Ephemeris for Physical Observations of the Moon for the First Half of 1900. By A. C. D. Crommelin.

Greenwich Midnight.	Selenographical Colong. of the Sun.	Selenographical Lat. of the Sun.	Geocentric Libration Sel. Long. of the Earth.	Geocentric Libration Lat. of the Earth.	Combined Amount.	Direction.
1900.	°	°	°	°	°	°
Jan. 1	279·06	+0·59	−3·38	−3·04	4·55	132·0
2	291·26	+0·61	−1·88	−4·47	4·85	157·2
3	303·44	+0·64	−0·26	−5·61	5·62	177·4
4	315·62	+0·66	+1·35	−6·38	6·52	192·0
5	327·80	+0·69	+2·83	−6·71	7·28	202·9
6	339·97	+0·71	+4·08	−6·62	7·78	211·6
7	352·13	+0·74	+5·04	−6·12	7·93	219·5
8	4·28	+0·76	+5·69	−5·28	7·75	227·2
9	16·43	+0·79	+6·01	−4·15	7·30	235·4
10	28·58	+0·82	+6·04	−2·83	6·67	244·9
11	40·71	+0·85	+5·81	−1·38	5·97	256·6
12	52·85	+0·87	+5·36	+0·12	5·36	271·3
13	64·98	+0·90	+4·71	+1·58	4·97	288·5
14	77·12	+0·92	+3·90	+2·95	4·89	307·1
15	89·25	+0·95	+2·95	+4·18	5·12	324·8
16	101·38	+0·98	+1·89	+5·18	5·51	340·0
17	113·52	+1·00	+0·72	+5·95	5·99	353·1
18	125·65	+1·02	−0·52	+6·46	6·48	4·6
19	137·79	+1·05	−1·79	+6·69	6·92	15·0
20	149·94	+1·07	−3·08	+6·63	7·30	24·9
21	162·09	+1·09	−4·32	+6·29	7·63	34·5
22	174·24	+1·11	−5·45	+5·67	7·87	43·9
23	186·40	+1·13	−6·39	+4·78	7·98	53·2
24	198·56	+1·14	−7·07	+3·65	7·95	62·7
25	210·73	+1·16	−7·42	+2·31	7·78	72·7
26	222·90	+1·18	−7·34	+0·80	7·38	83·8
27	235·08	+1·19	−6·81	−0·80	6·85	96·7
28	247·28	+1·21	−5·80	−2·40	6·27	112·5
29	259·47	+1·22	−4·34	−3·89	5·83	131·9

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Greenwich Midnight.		Selenographical		Geocentric Libration		Combined Amount.	Direction.
		Colong. of the Sun.	Lat. of the Sun.	Sel. Long. of the Earth.	Lat. of the Earth.		
1900.		°	°	°	°	°	°
Jan.	30	271·66	+1·24	−2·53	−5·14	5·73	153·8
	31	283·86	+1·25	−0·51	−6·04	6·06	175·2
Feb.	1	296·05	+1·26	+1·54	−6·52	6·70	193·3
	2	308·24	+1·28	+3·43	−6·54	7·38	207·7
	3	320·43	+1·30	+5·01	−6·12	7·90	219·3
	4	332·61	+1·31	+6·19	−5·33	8·16	229·3
	5	344·78	+1·33	+6·91	−4·23	8·10	238·5
	6	356·94	+1·35	+7·20	−2·93	7·77	247·9
	7	9·10	+1·36	+7·09	−1·50	7·24	258·1
	8	21·25	+1·38	+6·65	−0·04	6·65	269·6
	9	33·40	+1·40	+5·95	+1·40	6·11	283·2
	10	45·54	+1·41	+5·06	+2·75	5·76	298·5
	11	57·69	+1·43	+4·03	+3·95	5·64	314·4
	12	69·83	+1·44	+2·90	+4·97	5·76	329·7
	13	81·97	+1·45	+1·70	+5·76	6·00	343·6
	14	94·11	+1·46	+0·47	+6·29	6·31	355·7
	15	106·25	+1·47	−0·80	+6·54	6·58	7·0
	16	118·39	+1·48	−2·07	+6·52	6·84	17·6
	17	130·54	+1·49	−3·33	+6·21	7·05	28·2
	18	142·69	+1·50	−4·55	+5·63	7·23	38·9
	19	154·84	+1·50	−5·67	+4·80	7·43	49·7
	20	167·00	+1·51	−6·65	+3·74	7·64	60·6
	21	179·16	+1·51	−7·40	+2·48	7·81	71·5
	22	191·33	+1·52	−7·85	+1·07	7·92	82·2
	23	203·51	+1·52	−7·92	−0·44	7·94	93·2
	24	215·69	+1·52	−7·54	−1·97	7·79	104·6
	25	227·88	+1·52	−6·66	−3·43	7·49	117·2
	26	240·08	+1·53	−5·28	−4·72	7·08	131·8
	27	252·28	+1·53	−3·47	−5·72	6·69	148·8
	28	264·49	+1·53	−1·36	−6·33	6·48	167·9
Mar.	1	276·69	+1·53	+0·87	−6·49	6·55	187·6
	2	288·90	+1·53	+3·01	−6·19	6·88	205·9
	3	301·10	+1·54	+4·85	−5·46	7·30	221·6
	4	313·30	+1·54	+6·27	−4·38	7·64	235·1
	5	325·49	+1·54	+7·18	−3·07	7·80	246·9
	6	337·68	+1·55	+7·59	−1·62	7·75	258·0
	7	349·86	+1·55	+7·53	−0·13	7·53	269·0
	8	2·04	+1·55	+7·08	+1·33	7·20	280·6

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Greenwich Midnight.	Selenographical		Geocentric Libration		Combined Amount.	Direction.
	Colong.	Lat.	Sel. Long.	Lat.		
	of the Sun.		of the Earth.			
1900.	°	°	°	°	°	°
March 9	14·21	+1·55	+6·32	+2·69	6·87	293·1
10	26·37	+1·55	+5·33	+3·89	6·60	306·1
11	38·53	+1·55	+4·19	+4·91	6·46	319·5
12	50·69	+1·55	+2·96	+5·70	6·42	332·6
13	62·85	+1·55	+1·69	+6·24	6·46	344·8
14	75·01	+1·55	+0·40	+6·51	6·52	356·5
15	87·16	+1·54	−0·86	+6·50	6·56	7·5
16	99·32	+1·54	−2·09	+6·21	6·55	18·6
17	111·48	+1·53	−3·28	+5·64	6·52	30·2
18	123·63	+1·52	−4·39	+4·82	6·52	42·3
19	135·79	+1·51	−5·41	+3·77	6·60	55·1
20	147·95	+1·50	−6·29	+2·53	6·78	68·1
21	160·12	+1·49	−6·99	+1·15	7·08	80·7
22	172·30	+1·48	−7·43	−0·32	7·44	92·5
23	184·48	+1·47	−7·55	−1·80	7·76	103·4
24	196·66	+1·46	−7·28	−3·23	7·97	113·9
25	208·86	+1·45	−6·57	−4·51	7·96	124·4
26	221·06	+1·44	−5·40	−5·55	7·74	135·8
27	233·27	+1·42	−3·83	−6·25	7·33	158·5
28	245·49	+1·41	−1·92	−6·54	6·81	163·6
29	257·71	+1·40	+0·15	−6·37	6·37	181·3
30	269·93	+1·39	+2·20	−5·75	6·15	200·9
31	282·15	+1·38	+4·05	−4·75	6·25	220·5
April 1	294·27	+1·37	+5·53	−3·43	6·51	238·2
2	306·59	+1·36	+6·57	−1·94	6·85	253·6
3	318·80	+1·35	+7·11	−0·38	7·12	266·9
4	331·01	+1·34	+7·17	+1·16	7·26	279·2
5	343·21	+1·33	+6·82	+2·59	7·30	290·8
6	355·41	+1·32	+6·13	+3·85	7·23	302·1
7	7·60	+1·31	+5·17	+4·91	7·13	313·5
8	19·78	+1·29	+4·03	+5·74	7·01	324·9
9	31·96	+1·28	+2·78	+6·31	6·90	336·2
10	44·14	+1·26	+1·49	+6·60	6·76	347·3
11	56·32	+1·24	+0·21	+6·62	6·62	358·2
12	68·49	+1·23	−1·03	+6·35	6·44	9·2
13	80·66	+1·21	−2·19	+5·79	6·19	20·7
14	92·83	+1·19	−3·25	+4·98	5·95	33·1
15	105·00	+1·17	−4·20	+3·93	5·75	46·9

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Greenwich Midnight.	Selenographical Colong. of the Sun.	Lat.	Geocentric Libration Sel. Long. of the Earth.	Lat.	Combined Amount.	Direction.
1900.	°	°	°	°	°	°
April 16	117·17	+1·14	−5·01	+2·68	5·68	61·9
17	129·34	+1·12	−5·67	+1·28	5·81	77·3
18	141·52	+1·10	−6·15	−0·20	6·16	91·9
19	153·70	+1·08	−6·40	−1·70	6·62	104·9
20	165·89	+1·05	−6·39	−3·14	7·12	116·2
21	178·09	+1·03	−6·07	−4·43	7·51	126·1
22	190·29	+1·01	−5·43	−5·50	7·72	135·4
23	202·49	+0·99	−4·44	−6·26	7·67	144·7
24	214·71	+0·97	−3·13	−6·64	7·34	154·8
25	226·93	+0·94	−1·58	−6·59	6·78	166·5
26	239·17	+0·92	+0·11	−6·11	6·11	181·0
27	251·40	+0·90	+1·80	−5·21	5·51	199·1
28	263·64	+0·88	+3·36	−3·97	5·20	220·2
29	275·88	+0·87	+4·66	−2·49	5·28	241·9
30	288·12	+0·85	+5·60	−0·88	5·67	261·1
May 1	300·35	+0·83	+6·14	+0·73	6·18	276·8
2	312·58	+0·81	+6·25	+2·27	6·66	289·9
3	324·81	+0·79	+5·99	+3·64	7·01	301·3
4	337·03	+0·77	+5·38	+4·79	7·20	311·7
5	349·24	+0·75	+4·49	+5·70	7·25	321·8
6	1·45	+0·72	+3·41	+6·35	7·21	331·8
7	13·66	+0·70	+2·19	+6·70	7·04	341·9
8	25·86	+0·67	+0·93	+6·77	6·83	352·2
9	38·05	+0·65	−0·34	+6·55	6·56	3·0
10	50·25	+0·62	−1·53	+6·05	6·24	14·2
11	62·44	+0·60	−2·61	+5·27	5·88	26·4
12	74·62	+0·57	−3·54	+4·25	5·53	39·8
13	86·81	+0·54	−4·30	+3·01	5·25	55·0
14	98·99	+0·51	−4·86	+1·60	5·11	71·8
15	111·18	+0·48	−5·21	+0·09	5·21	89·0
16	123·36	+0·45	−5·34	−1·46	5·54	105·3
17	135·55	+0·42	−5·23	−2·94	6·00	119·3
18	147·74	+0·39	−4·91	−4·29	6·53	131·2
19	159·94	+0·36	−4·34	−5·42	6·94	141·3
20	172·14	+0·34	−3·57	−6·23	7·17	150·2
21	184·35	+0·31	−2·60	−6·69	7·17	158·8
22	196·57	+0·28	−1·47	−6·74	6·89	167·7
23	208·80	+0·26	−0·24	−6·37	6·38	177·8

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Greenwich Midnight.		Selenographical Colong. of the Sun.	Selenographical Lat. of the Sun.	Geocentric Libration Sel. Long. of the Earth.	Geocentric Libration Lat. of the Earth.	Combined Amount.	Direction.
1900.		°	°	°	°	°	°
May	24	221·03	+0·23	+1·03	−5·59	5·70	190·4
	25	233·27	+0·21	+2·25	−4·46	5·00	206·8
	26	245·52	+0·19	+3·35	−3·06	4·54	227·6
	27	257·76	+0·16	+4·25	−1·49	4·50	250·7
	28	270·01	+0·14	+4·90	+0·15	4·90	271·8
	29	282·26	+0·12	+5·24	+1·74	5·52	288·4
	30	294·51	+0·09	+5·26	+3·21	6·16	301·4
	31	306·75	+0·07	+4·96	+4·47	6·68	312·0
June	1	318·99	+0·04	+4·37	+5·49	7·02	321·5
	2	331·23	+0·02	+3·52	+6·23	7·16	330·5
	3	343·46	−0·01	+2·47	+6·68	7·12	339·7
	4	355·68	−0·03	+1·29	+6·83	6·95	349·3
	5	7·90	−0·06	+0·04	+6·69	6·69	359·7
	6	20·11	−0·09	−1·21	+6·27	6·39	10·9
	7	32·32	−0·12	−2·38	+5·57	6·05	23·1
	8	44·53	−0·15	−3·42	+4·61	5·74	36·6
	9	56·73	−0·18	−4·26	+3·43	5·47	51·2
	10	68·93	−0·21	−4·86	+2·06	5·27	67·0
	11	81·12	−0·24	−5·17	+0·56	5·20	83·8
	12	93·31	−0·26	−5·20	−1·01	5·30	101·0
	13	105·50	−0·29	−4·93	−2·55	5·55	117·4
	14	117·69	−0·32	−4·38	−3·97	5·91	132·2
	15	129·88	−0·35	−3·60	−5·17	6·29	145·2
	16	142·07	−0·38	−2·64	−6·08	6·63	156·5
	17	154·27	−0·41	−1·56	−6·62	6·81	166·7
	18	166·48	−0·44	−0·44	−6·75	6·76	176·3
	19	178·70	−0·46	+0·68	−6·46	6·50	186·0
	20	190·92	−0·48	+1·74	−5·78	6·04	196·8
	21	203·16	−0·51	+2·68	−4·75	5·45	209·4
	22	215·39	−0·53	+3·48	−3·44	4·89	225·3
	23	227·64	−0·55	+4·12	−1·95	4·55	244·7
	24	239·89	−0·57	+4·57	−0·36	4·58	265·5
	25	252·14	−0·59	+4·81	+1·23	4·96	284·3
	26	264·39	−0·61	+4·83	+2·72	5·54	299·4
	27	276·64	−0·63	+4·61	+4·04	6·13	311·2
	28	288·90	−0·66	+4·16	+5·14	6·61	321·0
	29	301·15	−0·68	+3·49	+5·97	6·90	329·7
	30	313·39	−0·70	+2·60	+6·51	7·01	338·2
July	1	325·64	−0·72	+1·54	+6·74	6·91	347·1

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The longitudes are reckoned in the plane of the Moon's equator, the axis of reference being the radius which passes through the mean centre of the visible disc. This axis therefore rotates with the Moon, and is not fixed in space.

The inclination of the Moon's equator to the ecliptic is taken as 1°·523, the value used in the *Connaissance des Temps*, that given by the *Nautical Almanac* being 1°·536.

I have taken the value of the physical libration in longitude from the *Berliner Jahrbuch* for the days on which it is tabulated there, the values on intermediate days being found by a graphical method. In other words, the whole of Professor Franz's formula for the physical libration has been used, instead of the principal term alone, as heretofore.

The physical libration in latitude has been applied in the above ephemeris for the first time, its value being likewise taken from the *Berliner Jahrbuch.* But in each case the sign of the libration as given in the *Jahrbuch* requires to be changed to reduce it to the system used here. Some doubts having been expressed to me as to whether the physical libration has hitherto been applied with the correct sign, I consulted Professor Franz, who replied that the sign heretofore used was correct, and that the sign of the physical libration in the *Berliner Jahrbuch* requires to be reversed both in longitude and latitude, in order to reduce it to the system used in the above ephemeris.

The colongitude of the Sun is 90° (or 450°) *minus* his selenographical longitude. It also is the selenographical longitude of the morning terminator reckoned eastward from the mean centre of the disc. Hence its value is approximately 270°, 0°, 90°, 180° at new Moon, first quarter, full Moon, last quarter respectively. The longitude of the evening terminator is of course 180° greater or less than that of the morning one.

When the geocentric libration in longitude is positive, the region brought into view is on the west limb; when negative, on the east.

When the geocentric libration in latitude is positive, the region brought into view is at the Moon's north pole; when negative, at the south.

The column "Combined Amount" gives the distance between the apparent and mean centres of the disc, and the column "Direction" gives the position-angle of the apparent centre from the mean centre, or, which is the same thing, the position-angle of the region which is most carried into view by libration. The angles are reckoned eastward from the northern extremity of the Moon's axis.

The terms "East" and "West" are used throughout with reference to our sky, and not as they would appear to an observer on the Moon.

Benvenue, 55 *Ulundi Road*, *Blackheath*, *S.E.*:
1899 *September* 30.